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BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

Application Number: 10/673,376
Filing Date: September 30, 2003
Appellant(s): HUGHES ET AL.

Ronald A. Rudder
For Appellant

EXAMINER'S ANSWER

This is in response to the appeal brief filed 12 February 2010 appealing from the Office action mailed 11 August 2009.

(1) Real Party in Interest

The examiner has no comment on the statement, or lack of statement, identifying by name the real party in interest in the brief.

(2) Related Appeals and Interferences

The examiner is not aware of any related appeals, interferences, or judicial proceedings which will directly affect or be directly affected by or have a bearing on the Board's decision in the pending appeal.

(3) Status of Claims

The following is a list of claims that are rejected and pending in the application:

1, 3, 11, 18, 20, 22, and 40-45.

(4) Status of Amendments After Final

The examiner has no comment on the appellant's statement of the status of amendments after final rejection contained in the brief.

(5) Summary of Claimed Subject Matter

The examiner has no comment on the summary of claimed subject matter contained in the brief.

(6) Grounds of Rejection to be Reviewed on Appeal

The examiner has no comment on the appellant's statement of the grounds of rejection to be reviewed on appeal. Every ground of rejection set forth in the Office action from which the appeal is taken (as modified by any advisory actions) is being maintained by the examiner except for the grounds of rejection (if any) listed under the

subheading "WITHDRAWN REJECTIONS." New grounds of rejection (if any) are provided under the subheading "NEW GROUNDS OF REJECTION."

(7) Claims Appendix

The examiner has no comment on the copy of the appealed claims contained in the Appendix to the appellant's brief.

(8) Evidence Relied Upon

5,556,500	HASEGAWA et al.	9-1996
7,227,097	KUMAR et al.	6-2007
5,474,649	KAVA et al	12-1995

(9) Grounds of Rejection

The following ground(s) of rejection are applicable to the appealed claims:

Claims 1, 3, 11, 18, 20, 22, and 40-43 are rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent 5,556,500 to Hasegawa et al. in view of U.S. Patent 7,227,097 to Kumar et al.

In regards to Claims 1, 18, 40, and 42, Hasegawa et al. teaches a semiconductor manufacturing system for processing a substrate using a plasma process, comprising: a plasma processing chamber 12 configured to facilitate said plasma process; a substrate holder 14 coupled to the processing chamber and configured to support a substrate S to be processed by attracting and holding the substrate is provided; a gas distribution system 34 configured to introduce a process gas to said processing chamber; a plasma source (RF power source 46) coupled to said processing chamber and configured to generate a plasma in the processing chamber; and a processing element coupled to the

processing chamber and the substrate holder; said processing element comprising a first substantially cylindrical ring shaped element 104 formed of a passive component and a second substantially cylindrical ring shaped element 106 formed of an active component configured to alter the chemistry of the processing when exposed to a plasma, said first and second elements 104 and 106 together forming a cylindrical ring shaped element 102; each of elements 104 and 106, and the cylindrical ring shaped element 102 formed by the elements 104 and 106 together configured to erode when exposed to a plasma process (see at least Column 9, Lines 36-47); each of said cylindrical elements 104, 106, and joint cylindrical element 102 having a first radially extending surface and a second radially extending surface opposite the first radially extending surface, wherein an inside diameter of each cylindrical unit (104, 106, or 102) forms an opening for disposition of the cylindrical unit around a substrate position in the semiconductor manufacturing system and the second radially extending surface is a substantially planar surface for disposition on a substrate holder in the semiconductor manufacturing system. (See at least Figure 1; Column 1, Lines 6-8; Column 3, Line 54 - Column 4, Line 3; Column 4, Lines 21-45; Column 6, Line 5 - Column 7, Line 8; Column 9, Lines 36-47)

Hasegawa et al. teaches an alternative embodiment (Figure 8) of a semiconductor manufacturing system for processing a substrate using a plasma process, comprising: a plasma processing chamber 204 configured to facilitate said plasma process; a substrate holder 208 coupled to the processing chamber and configured to support a substrate S to be processed by attracting and holding the

substrate is provided; a gas distribution system 205 configured to introduce a process gas to said processing chamber; a plasma source (magnet 207; RF power source 224) coupled to said processing chamber and configured to generate a plasma in the processing chamber; and a processing element coupled to the processing chamber and the substrate holder; said processing element comprising a cylindrical ring shaped element 208d comprising a passive component and configured to erode when exposed to a plasma process (see at least Column 9, Lines 36-47, which explains that a ring will erode when exposed to the plasma; and Column 10, Line 65 - Column 11, Line 2); said cylindrical element 208d having a first radially extending surface and a second radially extending surface opposite the first radially extending surface, wherein an inside diameter of the cylindrical unit 208d forms an opening for disposition of the cylindrical unit around a substrate position in the semiconductor manufacturing system and the second radially extending surface is a substantially planar surface for disposition on a substrate holder in the semiconductor manufacturing system. (See at least Figure 8; Column 1, Lines 6-8; Column 9, Lines 36-47; Column 10, Line 15 - Column 11, Line 52)

In regards to Claims 1, 18, 40, and 42, Hasegawa et al. does not expressly teach in either of the embodiment of Figure 1 or the embodiment of Figure 8 that a cylindrical element configured to erode when exposed to the plasma can comprise a cylindrical passive polymeric component *and* an active component, wherein the passive polymeric component is configured to erode when exposed to the plasma and *the active component is included as a part of the passive component* and configured to alter the chemistry of the processing when exposed to the plasma. In regards to Claims 3, 11,

20, and 22, Hasegawa et al. further does not teach wherein the active component comprises a distribution of solid particles encapsulated within the passive component.

Kumar et al. teaches a processing element for a plasma processing system (Column 3, Lines 18-20), comprising: a passive polymeric component (*a passive plasma catalyst…capable of inducing a plasma by deforming a local electric field*, Column 9, Lines 2-11, which can be *an electrically conductive polymer* or *a polymer nanocomposite*, Column 10, Lines 3-8) that can have various shapes including that of a cylindrical ring (*annular*; Column 10, Lines 50-53) and is configured to erode when exposed to a plasma process in the plasma processing system (it is *consumed by the plasma*; ex. Column 11, Lines 37-43); and an active component included as a part of said passive component and configured to alter the chemistry of the processing when exposed to the plasma process (*an additive [that] can include any material that a user wishes to add to the plasma*, such as *a dopant* or *a precursor material that, upon decomposition, can form the dopant*; Column 11, Lines 1-17). Kumar et al. teaches that the active component can comprise a distribution of solid particles (*the additive*) encapsulated within the passive component *(the passive plasma catalyst*). (Column 11, Lines 1-54; Figure 3)

In regards to Claims 1, 3, 11, 18, 20, 22, 40, and 42, it would have been obvious to one of ordinary skill in the art to modify the embodiment of either Figure 1 or Figure 8 of Hasegawa et al. to substitute a cylindrical ring-shaped element comprising a passive polymeric component, and an active component comprising a distribution of solid particles encapsulated within the passive component, the active component configured

to alter the chemistry of the processing when exposed to the plasma process, as taught by Kumar et al., for any of the cylindrical ring-shaped elements 104 and/or 106 of Figure 1, or the entire cylindrical ring-shaped element 102 formed by elements 104 and 106, and/or the cylindrical ring-shaped element 208d of Figure 8 of Hasegawa et al. The motivation for making such a modification, as taught by Kumar et al. (see at least Column 11, Lines 1-54), would have been to allow for the delivery of any desirable additive that a user wishes to add to the plasma, including a plasma catalyst or dopant.

In regards to Claims 41 and 43, Hasegawa et al. teaches that the cylindrical ring-shaped element 102 placed around the substrate position can have a stepped portion at a radially inner part of the cylindrical ring-shaped element 102 (Figure 1). The stepped portion is considered to be exposed to the plasma process, since plasma may enter the gap between the edge of the substrate and the stepped portion. Hasegawa et al. therefore teaches wherein the surface of the cylindrical ring-shaped element can comprise a surface exposed to the plasma process prior to surface exposure to the plasma process having a greater area (due to the additional surface area of vertical step) than an opposite surface of the cylindrical ring-shaped element that is *in contact* with a substrate holder surface. (Figure 1)

It would have been obvious to one of ordinary skill in the art, in the combination of Hasegawa et al. and Kumar et al., to form the passive polymeric ring-shaped component to have a stepped portion at a radially inner part of the cylindrical ring-shaped element, such that the surface of the cylindrical ring-shaped element can comprise a surface exposed to the plasma process prior to surface exposure to the

plasma process having a greater area (due to the additional surface area of vertical step) than an opposite surface of the cylindrical ring-shaped element that is *in contact* with a substrate holder surface, as suggested by the teachings of Hasegawa et al. The motivation for making such a modification, as taught by Hasegawa et al. (Column 6, Lines 46-64), would have been to prevent a local charge-up phenomenon at the peripheral portion of the substrate.

Claims 44 and 45 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hasegawa et al. in view of Kumar et al. as applied to claims 1 and 18 above, and further in view of U.S. Patent 5,474,649 to Kava et al.

The teachings of Hasegawa et al. and Kumar et al. were discussed above.

In regards to Claims 44 and 45, the combination of Hasegawa et al. and Kumar et al. as discussed above does not expressly teach wherein the passive polymeric component comprises an insulating material.

Kumar et al. further teaches that the passive component can further comprise an insulating material (*a substantially non-electrically conductive coating*; Column 12, Lines 10-28)

Kava et al. teaches that an electrically insulating polymeric material is a suitable material for forming a focus ring in a plasma chamber. (Column 4, Line 58 - Column 5, Line 34)

It would have been obvious to one of ordinary skill in the art to modify the passive polymeric ring-shaped component of Hasegawa et al. and Kumar et al. to comprise at least a coating of an electrically insulating polymeric material, as an electrically

insulating coating is taught by Kumar et al. to be an art-recognized suitable material for forming a passive component in a plasma chamber and Kava et al. teaches an electrically insulating polymeric material to be an art-recognized suitable electrically insulating material for use in a ring-shaped component in a plasma chamber. It has been held that the selection of a known material based on its suitability for its intended use is prima facie obviousness. *Sinclair & Carroll Co. v. Interchemical Corp.*, 325 U.S. 327, 65 USPQ 297 (1945).

(10) Response to Argument

In regards to Applicant's argument that Hasegawa et al. teaches away from the claimed passive polymeric component configured to erode when exposed to a plasma process in the semiconductor manufacturing system, this argument is not persuasive. Hasegawa et al. teaches a focus ring that erodes when exposed to plasma. See at least Column 9, Lines 36-47 and Column 10, Line 65 - Column 11, Line 2. A material which does not cause any reaction product that is substantially adsorbed on an etching target includes a material that forms a reaction product, i.e. an erodable passive material. In regards to Applicant's argument that Hasegawa et al. teaches that it is necessary that the focus ring have "anti-corrosion properties (anti-chemical properties with high resistance to etching gas)…[and] heat resistance", and that therefore Hasegawa et al. teaches away from an erodible polymeric component, this argument is not persuasive. The teachings of Hasegawa et al. upon which Applicant relies as teaching away from the claimed invention are part of the *background* of Hasegawa et al., i.e. the prior art upon which Hasegawa et al. seeks to improve. Contrary to

Applicant's assertion that the inventive focus ring structures of Hasegawa et al. must be formed of a material having a high resistance to etching gas, and are therefore contrary to the instantly claimed invention, Hasegawa et al. teaches a focus ring that erodes when exposed to plasma (see at least Column 9, Lines 36-47, which explains that a ring will erode when exposed to the plasma; and Column 10, Line 65 - Column 11, Line 2).

Additionally, the test for obviousness is not whether the features of a secondary reference may be bodily incorporated into the structure of the primary reference; nor is it that the claimed invention must be expressly suggested in any one or all of the references. Rather, the test is what the combined teachings of the references would have suggested to those of ordinary skill in the art. See In re Keller, 642 F.2d 413, 208 USPQ 871 (CCPA 1981). In the instant case, while Hasegawa alone does not teach that the erodible component is a polymeric component, Examiner maintains that one of ordinary skill in the art, *taking the combined teachings of Hasegawa and Kumar into consideration*, would have found it obvious, with a reasonable expectation of success in obtaining the predictable and desirable result of releasing the active component of Kumar by erosion of the passive component of Kumar, to replace one *or* both of the focus rings 104, 106 of Figure 1 taught by Hasegawa *or* the focus ring 208d of Figure 8 taught by Hasegawa with the ring comprising an active material embedded in a passive material as taught by Kumar.

In regards to Applicant's argument that Hasegawa et al. teaches away from having a focus ring that would readily erode, because it would readily consume the reactive species that would otherwise etch the intended portion of the wafer, this

argument is not persuasive. That Hasegawa et al. teaches a particular way of processing a wafer using a plasma, even what Hasegawa et al. considers to be the best way of processing the wafer, does not mean that Hasegawa et al. teaches *away* from any other plasma profile. Furthermore, the degree to which the erodible polymeric component taught by the combination of Hasegawa et al. and Kumaret al. would erode in the plasma, thereby consuming reactive species, would be dependent on a number of process variables, especially the type of process gas supplied to the chamber and the type of substrate to be processed, which are matters of intended use of the apparatus of Hasegawa et al. and Kumar et al. The apparatus of the combination of Hasegawa et al. and Kumar et al. would still be structurally capable of executing uniform processing of the substrate, based up on user selection of the process variables. Moreover, the erodible polymeric component of the combination of Hasegawa et al. and Kumar et al. releases the active component into the plasma, which would be expected by one of ordinary skill in the art to provide a benefit of adding a desired chemical to the plasma, a benefit which would be expected to offset any corresponding loss in the active species used to etch the passive polymer to release the active component.

In regards to Applicant's argument that the proposed modification suggested by the Examiner to modify the embodiment of Figure 1 or Figure 8 of Hasegawa is without a rationale as to why it is the focus ring of Hasegawa that is being modified, and in regards to Applicant's argument that the proposed modification suggested by the Examiner would be contrary to the purpose of Hasegawa to provide a uniform etching rate over the entire surface of the substrate to be processed, these arguments are not

persuasive. In regards to Applicant's arguments that including the plasma catalyst of Kumar in an erodable focus ring would deform the local electric field and thereby effect the plasma uniformity, and that active species would be lost by etching the passive polymer to release the active component, it is very respectfully noted that this argument must be considered mere attorney speculation not supported by evidence. *In re Scarborough*, 500 F.2d 560,566 182 USPQ 298,302 (CCPA 1974). Moreover, in regards to Applicant's argument that any combination of Hasegawa and Kumar would result in keeping the focus ring of Hasegawa and adding the plasma catalyst of KUmar by gas transport of powder or feeding a plasma catalyst sheet into the plasma cavity, the test for obviousness is not whether the features of a secondary reference may be bodily incorporated into the structure of the primary reference; nor is it that the claimed invention must be expressly suggested in any one or all of the references. Rather, the test is what the combined teachings of the references would have suggested to those of ordinary skill in the art. See *In re Keller*, 642 F.2d 413, 208 USPQ 871 (CCPA 1981). In the instant case, Examiner has presented a cogent technical reasoning as to why one of ordinary skill in the art would have found it obvious to combine the teachings of Hasegawa and Kumar to arrive at the claimed invention, specifically as motivated by the teachings of Kumar (Column 11, Lines 1-54) to allow for the delivery of any desirable additive that a user wishes to add to the plasma, including a plasma catalyst or dopant. The focus ring of Hasegawa *is* erodible, as discussed in detail above, and thus it would have been obvious to substitute the plasma catalyst at the focus ring position of Haswegaw. There is no reason to expect that any more active species would be lost

from the plasma than would already by lost in the apparatus of Hasegawa by collision with the focus ring. Moreover, it would be well within the mechanical skill of one of ordinary skill in the art to make any necessary minor tweaks to the plasma system, such as adjusting the power, to attain a desired etch rate and uniformity, and to incorporate the teachings of Kumar.

In response to Applicant's argument that the examiner's conclusion of obviousness is based upon improper hindsight reasoning, it must be recognized that any judgment on obviousness is in a sense necessarily a reconstruction based upon hindsight reasoning. But so long as it takes into account only knowledge which was within the level of ordinary skill at the time the claimed invention was made, and does not include knowledge gleaned only from the Applicant's disclosure, such a reconstruction is proper. See *In re McLaughlin*, 443 F.2d 1392, 170 USPQ 209 (CCPA 1971).

In regards to Applicant's argument that Kava also teaches away from the claimed passive polymeric component configured to erode when exposed to a plasma process in the semiconductor manufacturing system, this argument is not persuasive. Kava is applied in combination with Hasegawa and Kumar only to dependent Claims 44 and 45. Contrary to Applicant's argument, Examiner did not make a new art rejection in the Advisory Action, but rather was merely responding to Applicant's argument against the rejection of dependent Claims 44 and 45. In regards to Applicant's argument that the use of the electrically insulative coating of Kava is contrary to an erodable focus ring as claimed, since Kava teaches that the coating is to stabilize and retain residues, and is

not an erodible surface, this argument is not persuasive. The test for obviousness is not whether the features of a secondary reference may be bodily incorporated into the structure of the primary reference; nor is it that the claimed invention must be expressly suggested in any one or all of the references. Rather, the test is what the combined teachings of the references would have suggested to those of ordinary skill in the art. See *In re Keller*, 642 F.2d 413, 208 USPQ 871 (CCPA 1981). Kava suggests that an electrically insulative coating is suitable for use on a focus ring, but one of ordinary skill in the art, in combining the teachings of Hasegawa, Kumar, and Kava, could embody those teachings in multiple ways, such as only placing the coating on a surface of the focus ring not required to erode and not placing the coating on a surface intended to erode. It is noted that the feature that the focus ring is formed only of a passive insulating polymeric material is not recited in the rejected claim(s). Although the claims are interpreted in light of the specification, limitations from the specification are not read into the claims. See *In re Van Geuns*, 988 F.2d 1181, 26 USPQ2d 1057 (Fed. Cir. 1993).

(11) Related Proceeding(s) Appendix

No decision rendered by a court or the Board is identified by the examiner in the Related Appeals and Interferences section of this examiner's answer.

For the above reasons, it is believed that the rejections should be sustained.

Respectfully submitted,

/Maureen Gramaglia/

Examiner, Art Unit 1716

Conferees:

/Parviz Hassanzadeh/

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